

EXHIBIT 1

IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OHIO
EASTERN DIVISION

IN RE NATIONAL	:	MDL No. 2804
PRESCRIPTION OPIATE	:	CASE NO. 17-MD-2804
LITIGATION	:	(DAP)
	:	

EXPERT REPORT OF CRAIG J. MCCANN, PH.D., CFA
March 25, 2019

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I. Qualifications and Remuneration

A. Qualifications

1. I am the President of Securities Litigation and Consulting Group, Inc. (“SLCG”). SLCG was founded in 2000 to apply finance, economics, statistics and mathematics in litigation and consulting. SLCG staff includes professionals with PhDs and advanced degrees in applied mathematics, statistics, finance and economics.

2. Prior to founding SLCG, I was a Director at LECG, a business unit of Navigant Consulting, Inc. Prior to joining LECG, I was Managing Director, Securities Litigation at KPMG LLP for two years. I was a senior financial economist in the Office of Economic Analysis at the U.S. Securities and Exchange Commission (the “SEC”) from 1992 to 1993 and from 1994 to 1995.

3. I have taught graduate economics and finance courses at the University of South Carolina, Virginia Tech, Georgetown University and at the University of Maryland, College Park.

4. I have been hired as a consultant and expert witness in investigations by many state and federal agencies including the SEC, the Federal Deposit Insurance Corporation and the U.S. Department of Justice.

5. My work as a consultant and expert witness over the past 25 years has required me to extract or receive data, process and validate the data and produce varied statistical analyses.

6. I earned a Ph.D. in Economics from the University of California, at Los Angeles. My graduate studies included extensive coursework in mathematics, statistics and econometrics.

7. My resume, which includes a list of all publications authored by me within the last 10 years and the cases in which I have testified as an expert at trial or by deposition within the last four years, is attached as Appendix 1.

B. Remuneration

8. SLCG is being compensated for its time and expenses. My hourly rate is \$475 per hour. Other SLCG personnel working on this matter have billing rates of \$100 to \$350 per hour.

II. Materials Reviewed

9. In preparing this report, I have considered the following documents:

- a. Automation of Reports and Consolidated Orders System (ARCOS) electronic data, received from the Drug Enforcement Administration (hereafter, “ARCOS Data”);
- b. “ARCOS Retail Drug Summary Reports,” Drug Enforcement Administration, 2000-2017, (available at www.deadiversion.usdoj.gov/arcos/retail_drug_summary/index.html);
- c. “National Drug Code Dictionary,” Drug Enforcement Administration, November 2018 (current version available at www.deadiversion.usdoj.gov/arcos/ndc/ndcfile.txt);

l. U.S. Dep't of Justice, DEA, Diversion Investigators Manual (1996) (CAH_MDL2804_02203353);

m. Other documents cited in the text and footnotes below.

III. Assignment

10. I have been asked by Plaintiffs' Counsel to document how I processed, validated and augmented opioid transaction data produced by the Drug Enforcement Administration ("DEA") and from the Defendants.

11. I have been asked to summarize shipments in the ARCOS Data, especially those shipments into Cuyahoga County and Summit County.

12. I have also been asked to report the results of applying certain algorithms to the ARCOS Data.

IV. Summary of Opinions

13. Based upon my comparison of the ARCOS Data produced by the DEA and the public ARCOS Retail Drug Summary Reports, I conclude that, after correcting a relatively small number of records, the ARCOS Data produced by the DEA is reliable.

14. I conclude that the ARCOS Data is reliable because it closely matches the DEA's Retail Drug Summary Reports for January 2006 through December 2014. Retail Drug Summary Reports summarize the weight of drugs in reported transactions with consumers in each of the 50 states and the District of Columbia. Where there were discrepancies between the ARCOS Data produced by the DEA and the Retail Drug Summary Reports, I was able

to identify and correct the error in either the ARCOS Data or the Retail Drug Summary Reports.

15. The ARCOS Data produced by the DEA also closely matches transaction data produced in discovery by Cardinal Health, McKesson Corp, Walgreens, CVS, Anda, H.D. Smith, Walmart, HBC, Discount Drug Mart, and Prescription Supply from their business records. I expect the data produced in discovery by the Defendants to be accurate. As with the Retail Drug Summary Reports, I have been able to identify and correct relatively minor discrepancies between the ARCOS Data produced by the DEA for transactions in Cuyahoga County and Summit Counties in Ohio from January 2006 through December 2014 and the Defendants' transaction data.

16. The data on opioid shipments from January 2006 through December 2014 produced in discovery by AmerisourceBergen does differ from what AmerisourceBergen reported to the DEA as reflected in the ARCOS Data.

17. I conclude from my review of the ARCOS Data, the Retail Drug Summary Reports, and transaction data produced in discovery by the Defendants that the ARCOS Data is reliable. Based on this analysis, I further conclude that the transaction records produced in discovery by the Defendants other than AmerisourceBergen are a reliable source of transactions data before 2006 and after 2014 for the varied time periods covered by the Defendants' productions.

18. In the next section, I describe the ARCOS Data produced by the DEA and report national summary statistics for the ARCOS Data, after correcting minimal errors explained fully in Appendix 2. In Section VI, I

compare the processed ARCOS Data to Retail Drug Summary Reports published by the DEA to verify that the shipments of opioids to dispensing outlets in the ARCOS Data is consistent with the amount of each opioid the DEA calculates was shipped into each 3-digit zip code each quarter. I also compare the ARCOS Data to the opioid transaction data produced in discovery by the Defendants.

19. In Section VII, I explain the information I used to supplement the ARCOS Data.

20. In Section VIII, I report summary statistics for subsets of the processed ARCOS Data covering Cuyahoga County and Summit County in Ohio. These summary statics show that that between 2006 and 2014, Dispensers in Cuyahoga County received 8.55 billion MME of opioids. Given the county's 1.28 million average population, Dispensers received enough opioids for every resident in the County to consume 742 MME every year from 2006 to 2014. These summary statistics also show that between 2006 and 2014, Dispensers in Summit County received 5.16 billion MME of opioids. Given the County's average population of 542,000, Dispensers received enough opioids for every resident in the county to consume 1,057 MME every year from 2006 to 2014.

21. In Section IX, I describe a non-exhaustive set of algorithms that can be systematically applied to the ARCOS Data and present a check on the various estimates presented. In Section X, I provide certain estimates regarding the total aggregate shipments of opioids into Ohio from 1997 to 2018. In Section XI, I describe certain charts and tables that are attached to this report. In Section XII I give my conclusions.

22. I continue to review documents and gather information and reserve the right to update my analysis and opinions based upon that further review of documents and based on any new information - including possibly reports of other experts - I may receive.

V. ARCOS Data

23. ARCOS is the system through which manufacturers and distributors report transactions of controlled substances to the DEA.¹ ARCOS Data covers all fifty states, the District of Columbia, Puerto Rico, Guam, U.S. Virgin Islands, American Samoa, and Northern Mariana Islands, Armed Forces-Americas, Armed Forces-EMEA, Armed Forces-Pacific, and Palau.

A. Receipt of ARCOS Data from the DEA

24. The DEA produced a subset of ARCOS Data reflecting transactions in drug products containing one or more of fourteen drugs: buprenorphine, codeine, dihydrocodeine, fentanyl, hydrocodone, hydromorphone, levorphanol, meperidine, methadone, morphine, powdered opium, oxycodone, oxymorphone, and tapentadol from January 1, 2006 through December 31, 2014.

25. On or about April 20, 2018 the DEA produced ARCOS Data produced reflecting transactions in oxycodone, hydrocodone, hydromorphone, and fentanyl for six states: Alabama, Florida, Illinois, Michigan, Ohio and West Virginia. On or about May 20, 2018 the DEA produced transaction data for these four drugs for the remaining states. The

¹ www.deadiversion.usdoj.gov/arcos/index.html, accessed on 29 November 2018.

IX. Transaction Analysis

130. I implemented various approaches to identify transactions meeting specified criteria using the non-public ARCOS Data from 2006 to 2014, supplemented with Defendant transaction data where the ARCOS Data is obviously missing transactions that are included in the transactions produced by Defendants in discovery and to the extent I have Defendant transaction data for the periods before 2006 and after 2014. I calculated the results separately for each of twelve controlled substance drug codes.⁵⁴

A. Maximum Monthly, Trailing Six-month Threshold

131. Under the first approach, I identify transactions that cause the number of dosage units shipped by a Distributor to a Pharmacy in a calendar month to exceed the highest number of dosage units shipped by the Distributor to the Pharmacy in any one of the six preceding calendar months. For example, if the number of dosage units containing hydrocodone shipped from a Distributor to a Pharmacy in February, March, April, May, June, and July were 5,000; 10,000; 7,000; 8,000; 9,000; and 9,500 respectively, a requested transaction in August would be flagged if it would cause the number of dosage units containing hydrocodone the Distributor shipped to the Pharmacy to exceed 10,000. Any reported transactions containing hydrocodone on that date and all reported transactions containing hydrocodone from that Distributor to that Pharmacy thereafter are flagged.

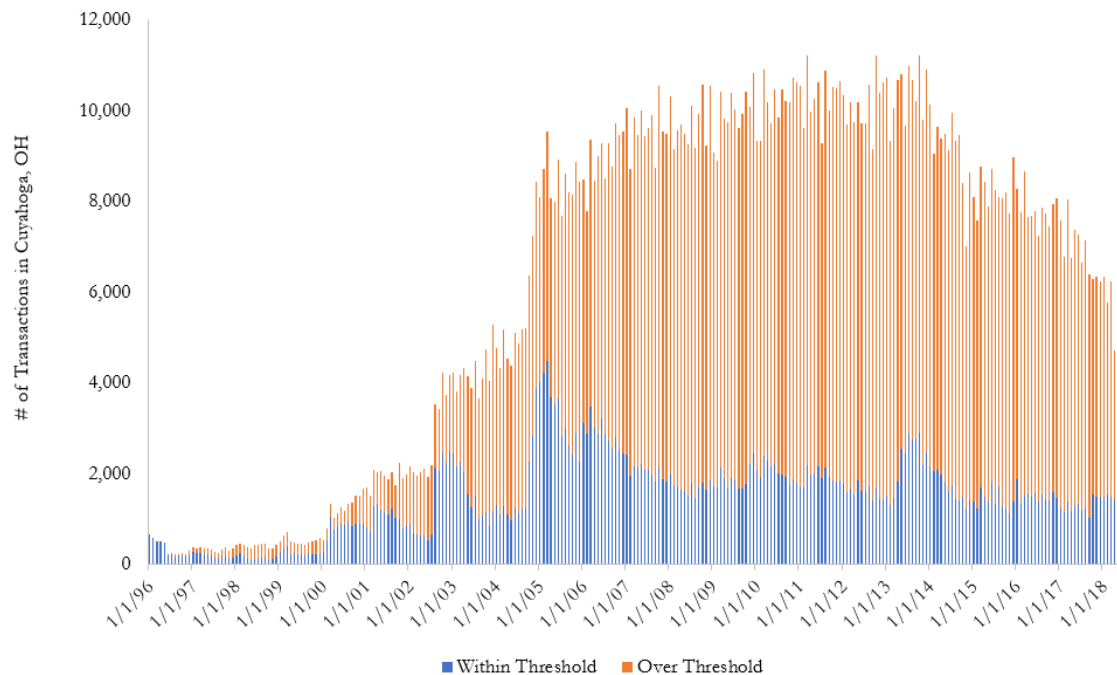
132. In this approach and the others implemented below I have been asked by Counsel to assume that the Distributor did not effectively investigate

⁵⁴ I do not analyze transactions in two treatment drugs: buprenorphine and methadone.

the flagged transactions and so every subsequent transaction of that drug code is also flagged because the Distributor had an unfulfilled obligation to detect and investigate the first flagged transaction.

133. Figure 11 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Cuyahoga County from 1996 to 2018. The Trailing Six-Month Maximum Threshold methodology flags 76.0% of transactions accounting for 89.6% of dosage units, 73.5% of MME and 83.2% of drug weight shipped into Cuyahoga County. Additional charts and tables reflecting the result of applying this methodology and the methodologies below to each Distributor are in Appendix 10.

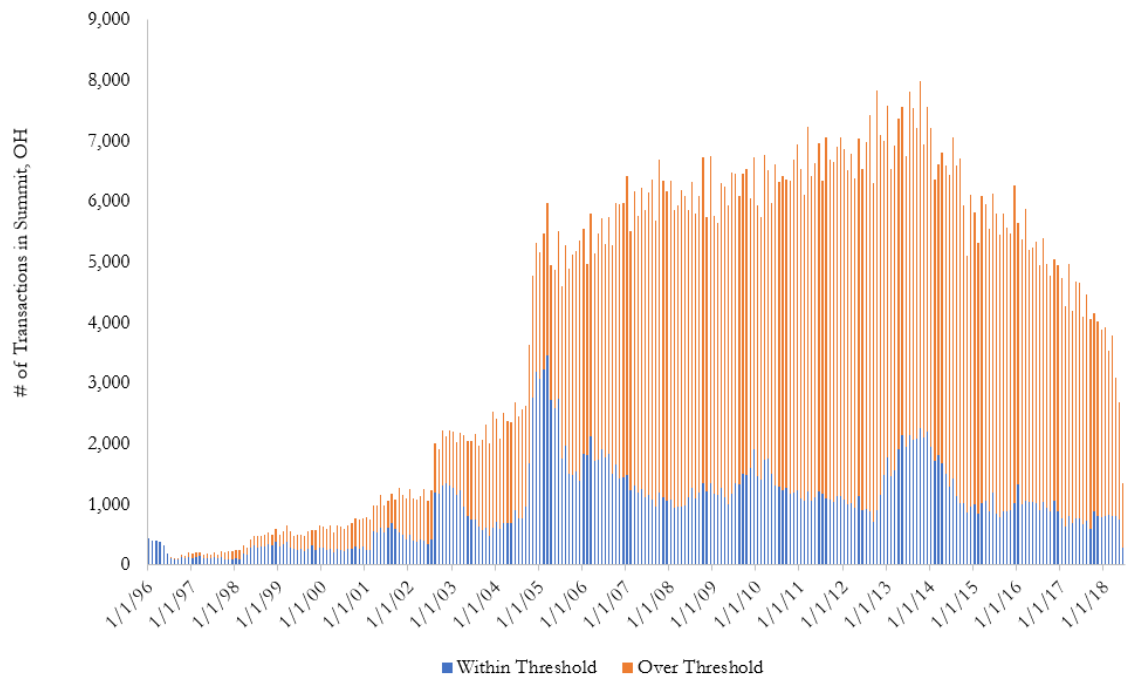
Figure 11 Trailing Six-Month Maximum Threshold Flagged Transactions, Cuyahoga County, OH 1996-2018



134. Figure 12 illustrates total transactions from Distributors to retail and chain pharmacies into Summit County from 1996 to 2018. The Trailing Six-Month Maximum Threshold methodology flags 75.4% of transactions

accounting for 88.5% of dosage units, 71.4% of MME and 83.1% of drug weight shipped into Summit County.

Figure 12 Trailing Six-Month Maximum Threshold Flagged Transactions, Summit County, OH, 1996-2018



135. Table 24 and Table 25 summarize the transactions in transactions flagged based on the Trailing Six-Month Maximum Threshold Approach in Cuyahoga and Summit Counties.

Table 24 Trailing Six-Month Maximum Threshold Flagged Transactions,
Cuyahoga County, OH 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	99,137	49,339	14,957	2,874	545	11,597	178,449
Anda, Inc	700	1,723	0	2	0	69	2,494
Cardinal Health	192,799	94,450	26,389	3,061	3,974	30,020	350,693
CVS	n/a	109,055	n/a	n/a	n/a	8,772	117,827
Discount Drug Mart	n/a	32,583	0	n/a	n/a	3,229	35,812
H. D. Smith	269	0	0	0	0	0	269
HBC Service Co	4,909	41,114	0	0	0	1,275	47,298
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	129,021	89,263	9,185	759	538	6,265	235,031
Miami-Luken	0	0	0	0	n/a	0	0
Prescription Supply	5,008	489	1,220	134	0	40	6,891
Rite Aid	n/a	18,828	n/a	n/a	n/a	2,748	21,576
Walgreens	97,401	100,421	19,462	3,900	0	10,744	231,928
Wal-Mart	16,070	25,737	477	76	0	990	43,350
Total	545,314	563,002	71,690	10,806	5,057	75,749	1,271,618

Table 25 Trailing Six-Month Maximum Threshold Flagged Transactions, Summit County, OH 1996-2018

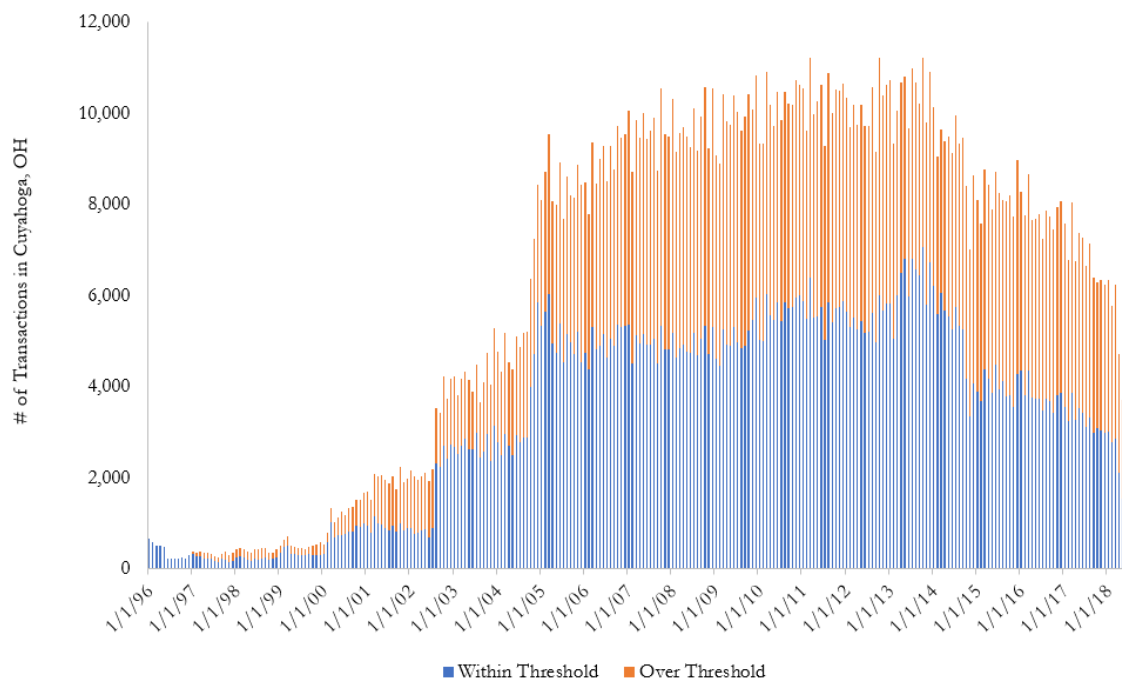
# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	77,175	52,681	21,289	6,341	2,830	10,804	171,120
Anda, Inc	690	1,302	121	2	0	188	2,303
Cardinal Health	111,200	50,300	24,731	5,707	2,638	13,065	207,641
CVS	n/a	45,927	n/a	n/a	n/a	2,624	48,551
Discount Drug Mart	n/a	8,500	0	n/a	n/a	720	9,220
H. D. Smith	60	125	0	n/a	0	0	185
HBC Service Co	2,682	26,651	0	0	0	703	30,036
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	96,172	64,409	20,338	5,156	4,116	6,280	196,471
Miami-Luken	2,999	1,308	391	0	236	0	4,934
Prescription Supply	16	4	0	0	0	0	20
Rite Aid	n/a	10,953	n/a	n/a	n/a	898	11,851
Walgreens	39,284	47,489	11,596	3,050	0	2,669	104,088
Wal-Mart	9,010	15,052	777	173	0	393	25,405
Total	339,288	324,701	79,243	20,429	9,820	38,344	811,825

B. Twice Trailing Twelve-Month Average Pharmacy Dosage Units

136. I identify transactions that cause the number of dosage units shipped by a Distributor to a Pharmacy in a calendar month to exceed twice the trailing twelve-month average dosage units to retail and chain pharmacies served by the Distributor. I have been asked by Counsel to assume that the Distributor did not effectively investigate the flagged transactions and so every subsequent transaction of that drug code is also flagged because the Distributor had an unfulfilled obligation to detect and investigate the first flagged transaction.

137. Figure 13 illustrates total opioid shipments into Cuyahoga County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after 2014. The Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology flags 45.6% of transactions accounting for 54.9% of dosage units, 57.1% of MME and 59.0% of drug weight shipped into Cuyahoga County.

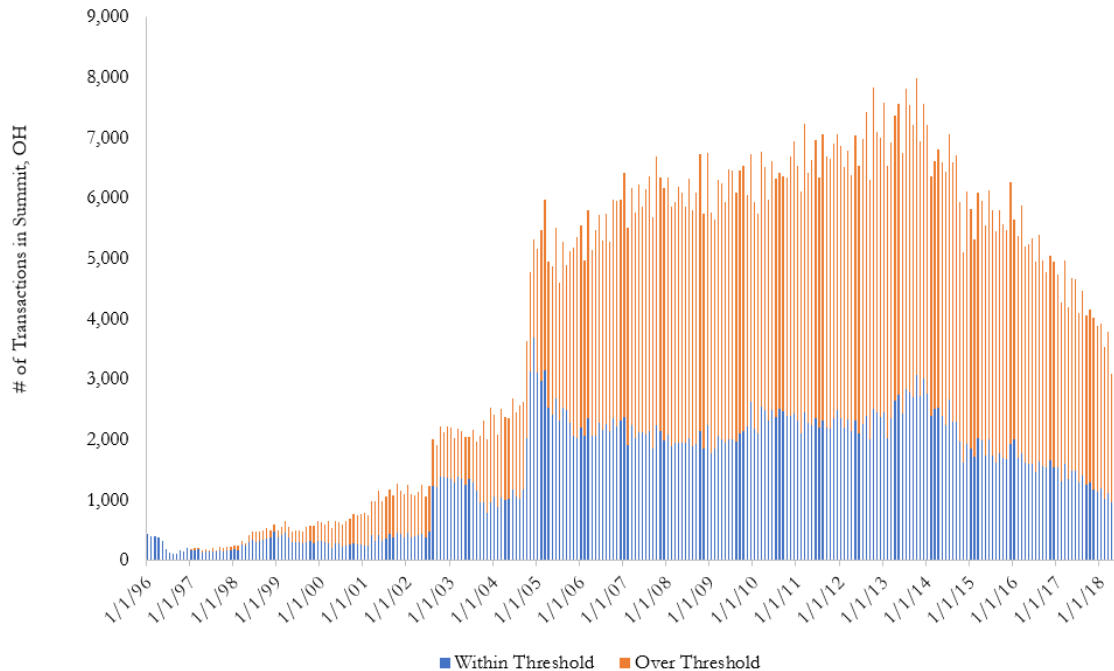
Figure 13 Twice Trailing Twelve-Month Average Pharmacy Dosage Units, Flagged Transactions, Cuyahoga County, OH 1996-2018



138. Figure 14 illustrates total shipments into Summit County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after 2014. The Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold

methodology flags 62.9% of transactions accounting for 72.5% of dosage units, 74.4% of MME and 72.3% of drug weight shipped to Summit County.

Figure 14 Twice Trailing Twelve-Month Average Pharmacy Dosage Units, Flagged Transactions, Summit County, OH 1996-2018



139. Table 26 and Table 27 summarize the transactions in transactions flagged based on the Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold in Cuyahoga and Summit Counties.

Table 26 Twice Trailing Twelve-Month Average Pharmacy Dosage Units
Threshold Flagged Transactions, Cuyahoga County, 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	45,288	26,985	8,256	2,502	844	16,731	100,606
Anda, Inc	587	950	51	6	0	256	1,850
Cardinal Health	121,206	82,155	24,003	4,621	5,713	56,834	294,532
CVS	n/a	34,001	n/a	n/a	n/a	6,422	40,423
Discount Drug Mart	n/a	32,848	0	n/a	n/a	2,554	35,402
H. D. Smith	311	0	12	4	11	17	355
HBC Service Co	4,942	4,690	29	104	0	669	10,434
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	51,631	68,503	8,532	1,505	1,344	22,790	154,305
Miami-Luken	0	0	0	0	n/a	0	0
Prescription Supply	802	471	1,176	174	20	690	3,333
Rite Aid	n/a	4,145	n/a	n/a	n/a	1,452	5,597
Walgreens	42,801	18,937	15,801	5,665	30	22,409	105,643
Wal-Mart	8,469	806	494	117	0	1,357	11,243
Total	276,037	274,491	58,354	14,698	7,962	132,181	763,723

Table 27 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Summit County, OH 1996-2018

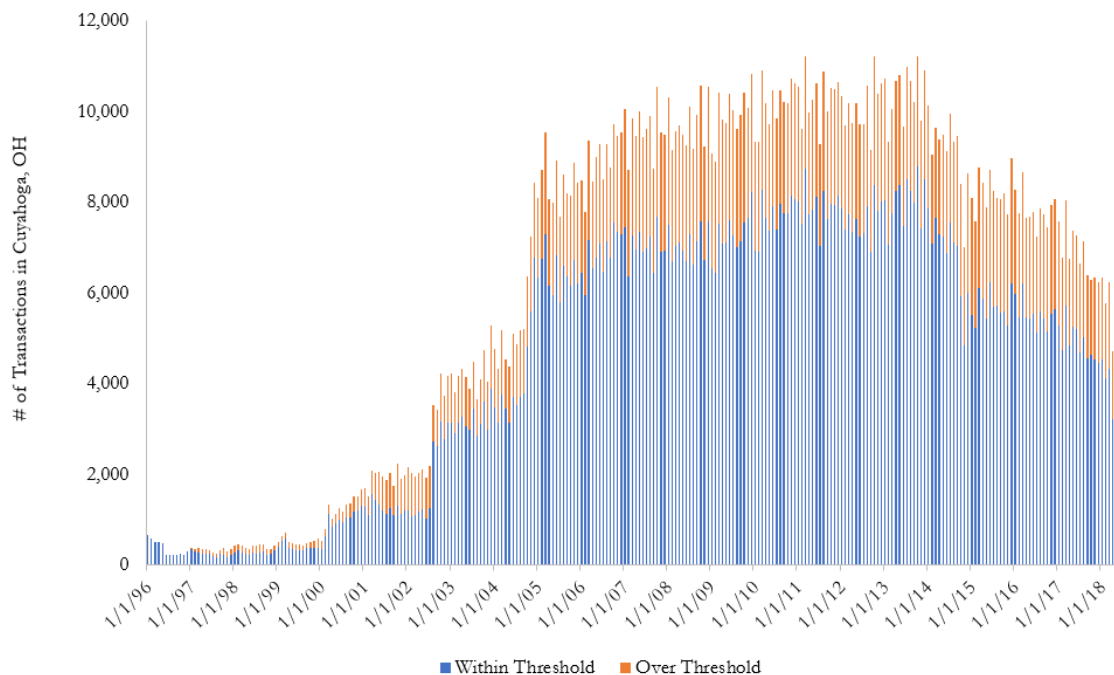
# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	41,408	48,241	17,443	6,140	3,737	22,741	139,710
Anda, Inc	1,081	1,245	221	22	0	325	2,894
Cardinal Health	84,118	48,828	27,703	7,966	4,458	35,525	208,598
CVS	n/a	27,081	n/a	n/a	n/a	1,443	28,524
Discount Drug Mart	n/a	7,405	0	n/a	n/a	533	7,938
H. D. Smith	0	105	0	n/a	0	23	128
HBC Service Co	2,025	16,692	200	28	22	491	19,458
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	64,582	62,291	20,257	6,303	5,538	24,320	183,291
Miami-Luken	2,939	1,222	452	88	304	388	5,393
Prescription Supply	0	4	0	1	0	0	5
Rite Aid	n/a	8,235	n/a	n/a	n/a	376	8,611
Walgreens	15,942	28,076	10,431	3,488	44	9,018	66,999
Wal-Mart	2,657	695	729	199	27	622	4,929
Total	214,752	250,120	77,436	24,235	14,130	95,805	676,478

C. Three Times Trailing Twelve-Month Average Pharmacy Dosage Units

140. I identify transactions that cause the number of dosage units shipped by a Distributor to a Pharmacy in a calendar month to exceed three times the trailing twelve-month average dosage units to retail and chain pharmacies served by the Distributor. I have been asked by Counsel to assume that the Distributor did not effectively investigate the flagged transactions and so every subsequent transaction of that drug code is also flagged because the Distributor had an unfulfilled obligation to detect and investigate the first flagged transaction.

141. Figure 15 illustrates total opioid shipments into Cuyahoga County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after 2014. The Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology flags 26.0% of transactions accounting for 32.3% of dosage units, 33.5% of MME and 34.8% of drug weight shipped into Cuyahoga County.

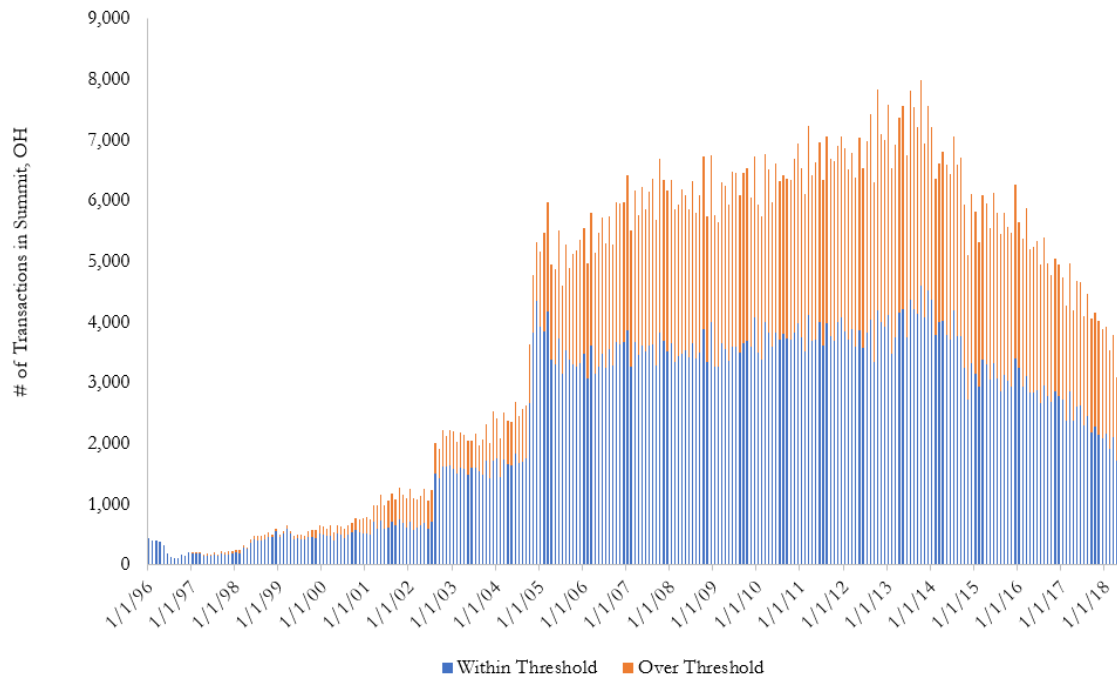
Figure 15 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Flagged Transactions, Cuyahoga County, OH 1996-2018



142. Figure 16 illustrates total shipments into Summit County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after 2014. The Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology flags 40.5% of transactions accounting for 50.0% of

dosage units, 53.3% of MME and 51.4% of drug weight shipped into Summit County.

Figure 16 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Flagged Transactions, Summit County, OH 1996-2018



143. Table 28 and Table 29 summarize the transactions in transactions flagged based on the Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold in Cuyahoga and Summit Counties.

Table 28 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Cuyahoga County, OH 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	22,663	14,792	3,933	1,319	289	10,561	53,557
Anda, Inc	306	584	3	0	0	182	1,075
Cardinal Health	62,297	67,273	17,572	2,867	4,475	39,223	193,707
CVS	n/a	13,485	n/a	n/a	n/a	2,619	16,104
Discount Drug Mart	n/a	32,445	0	n/a	n/a	1,995	34,440
H. D. Smith	311	0	0	0	0	0	311
HBC Service Co	1,652	2,069	12	34	0	42	3,809
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	31,620	41,655	4,172	730	581	13,998	92,756
Miami-Luken	0	0	0	0	n/a	0	0
Prescription Supply	96	468	838	148	1	428	1,979
Rite Aid	n/a	2,631	n/a	n/a	n/a	719	3,350
Walgreens	909	4,490	9,292	3,753	9	11,522	29,975
Wal-Mart	3,239	0	177	69	0	150	3,635
Total	123,093	179,892	35,999	8,920	5,355	81,439	434,698

Table 29 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Summit County, OH 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	26,024	40,096	10,643	4,823	3,051	13,724	98,361
Anda, Inc	981	993	177	21	0	295	2,467
Cardinal Health	49,733	42,267	21,073	6,408	2,295	24,609	146,385
CVS	n/a	17,930	n/a	n/a	n/a	370	18,300
Discount Drug Mart	n/a	7,278	0	n/a	n/a	403	7,681
H. D. Smith	0	91	0	n/a	0	23	114
HBC Service Co	857	8,099	103	0	13	114	9,186
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	36,410	48,607	16,642	4,721	4,198	16,232	126,810
Miami-Luken	0	1,111	0	79	243	331	1,764
Prescription Supply	0	4	0	0	0	0	4
Rite Aid	n/a	2,062	n/a	n/a	n/a	129	2,191
Walgreens	0	6,712	6,788	2,491	44	4,516	20,551
Wal-Mart	1,403	0	713	173	0	131	2,420
Total	115,408	175,250	56,139	18,716	9,844	60,877	436,234

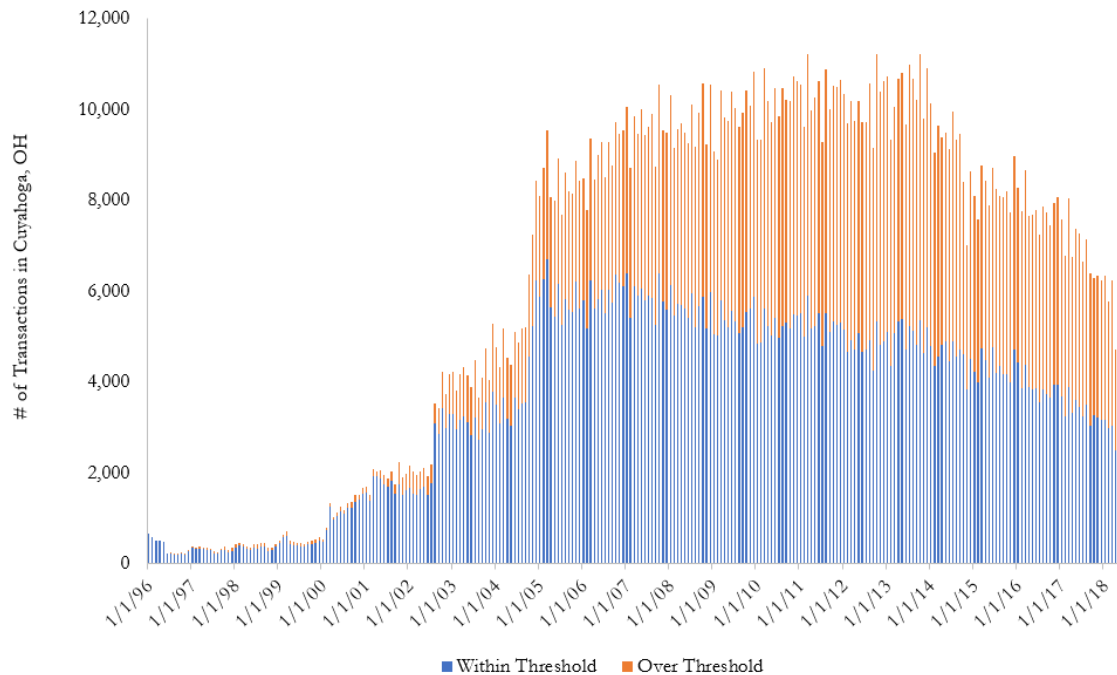
D. Maximum 8,000 Dosage Units Monthly

144. I identify transactions that cause the number of dosage units shipped by a Distributor to a Pharmacy in a calendar month to exceed 8,000 dosage units. I have been asked by Counsel to assume that the Distributor did not effectively investigate the flagged transactions and so every subsequent transaction of that drug code is also flagged because the Distributor had an unfulfilled obligation to detect and investigate the first flagged transaction.

145. Figure 17 illustrates total opioid shipments into Cuyahoga County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after

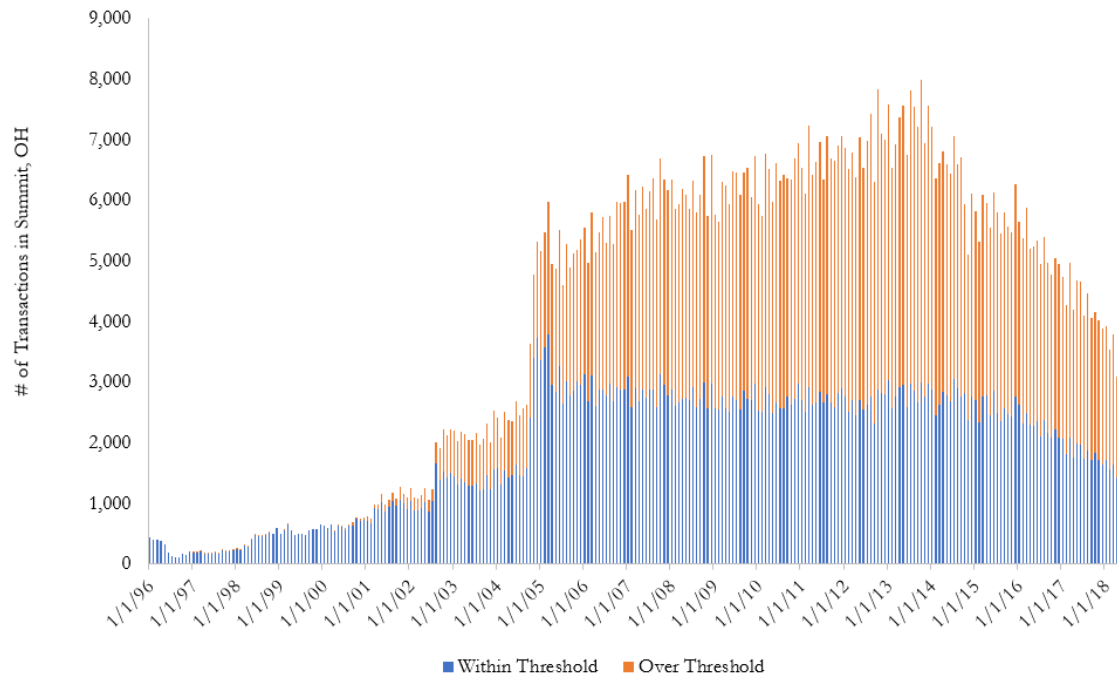
2014. The Maximum 8,000 Dosage Units Monthly Threshold methodology flags 42.6% of transactions accounting for 61.4% of dosage units, 50.2% of MME and 49.9% of drug weight shipped into Cuyahoga County.

Figure 17 Maximum 8,000 Dosage Units Monthly Flagged Transactions, Cuyahoga County, OH 1996-2018



146. Figure 18 illustrates total shipments into Summit County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after 2014. The Maximum 8,000 Dosage Units Monthly Threshold methodology flags 52.4% of transactions accounting for 76.0% of dosage units, 54.7% of MME and 62.7% of drug weight shipped into Summit County.

Figure 18 Maximum 8,000 Dosage Units Monthly Flagged Transactions, Summit County, OH 1996-2018



147. Table 30 and Table 31 summarize the transactions in transactions flagged based on the Maximum 8,000 Dosage Units Monthly Threshold Approach in Cuyahoga and Summit Counties.

Table 30 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Cuyahoga County, OH 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	94,012	27,456	949	0	0	1,187	123,604
Anda, Inc	17	55	0	0	0	0	72
Cardinal Health	110,826	48,016	2,102	0	0	1,731	162,675
CVS	n/a	63,845	n/a	n/a	n/a	0	63,845
Discount Drug Mart	n/a	20,875	0	n/a	n/a	0	20,875
H. D. Smith	308	0	0	0	0	0	308
HBC Service Co	3,992	28,758	0	0	0	0	32,750
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	77,402	31,364	0	0	0	0	108,766
Miami-Luken	0	0	0	0	n/a	0	0
Prescription Supply	3,312	0	0	0	0	0	3,312
Rite Aid	n/a	9,603	n/a	n/a	n/a	0	9,603
Walgreens	88,496	74,958	0	0	0	0	163,454
Wal-Mart	9,165	15,540	0	0	0	0	24,705
Total	387,530	320,470	3,051	0	0	2,918	713,969

Table 31 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Summit County, OH 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	68,640	50,724	3,831	1,071	2,265	0	126,531
Anda, Inc	811	25	109	0	0	0	945
Cardinal Health	80,037	31,077	3,214	927	748	570	116,573
CVS	n/a	46,272	n/a	n/a	n/a	0	46,272
Discount Drug Mart	n/a	6,299	0	n/a	n/a	0	6,299
H. D. Smith	0	0	0	n/a	0	0	0
HBC Service Co	2,107	25,874	0	0	0	0	27,981
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	78,847	44,278	4,036	1,050	0	0	128,211
Miami-Luken	3,180	0	0	0	0	0	3,180
Prescription Supply	0	0	0	0	0	0	0
Rite Aid	n/a	12,057	n/a	n/a	n/a	0	12,057
Walgreens	36,774	48,454	0	0	0	0	85,228
Wal-Mart	2,897	7,740	0	0	0	0	10,637
Total	273,293	272,800	11,190	3,048	3,013	570	563,914

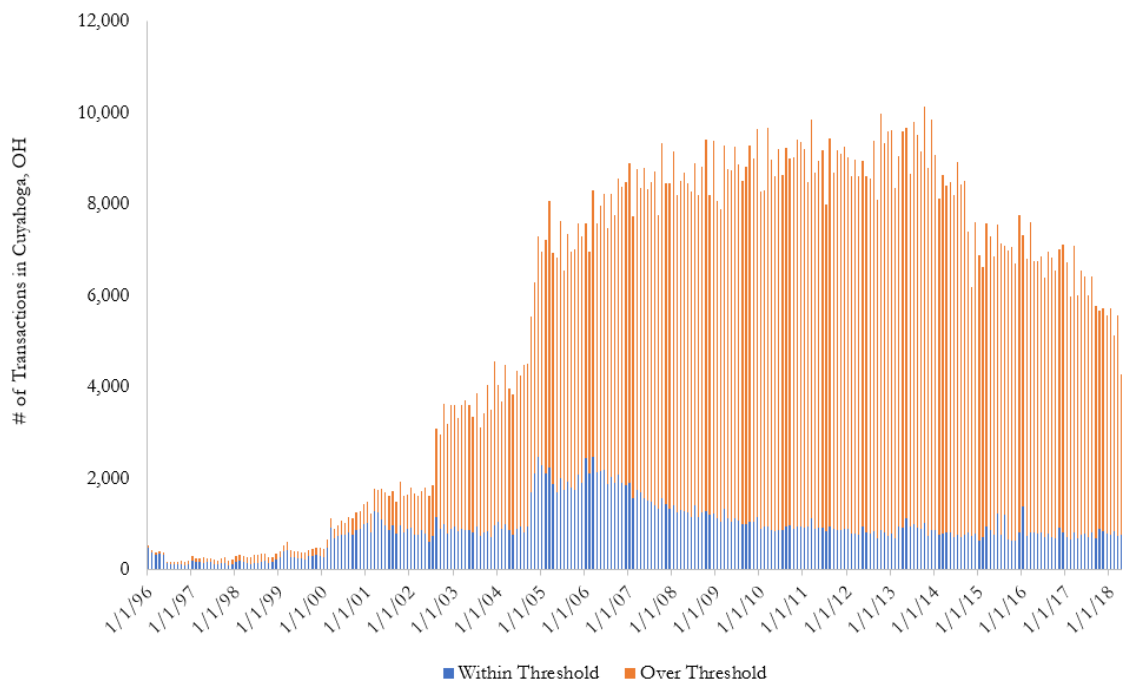
E. Maximum Daily Dosage Units

148. I identify transactions that cause the number of dosage units shipped by a Distributor to a Pharmacy in a day to exceed a number of dosage units that varies by drug type and within some drug types by formulation.⁵⁵ I have been asked by Counsel to assume that the Distributor did not effectively investigate the flagged transactions and so every subsequent transaction of that drug code is also flagged because the Distributor had an unfulfilled obligation to detect and investigate the first flagged transaction.

⁵⁵ Maximum Daily Dosage Units used as specified in CAH_MDLPRIORPRO_DEA07_01384160

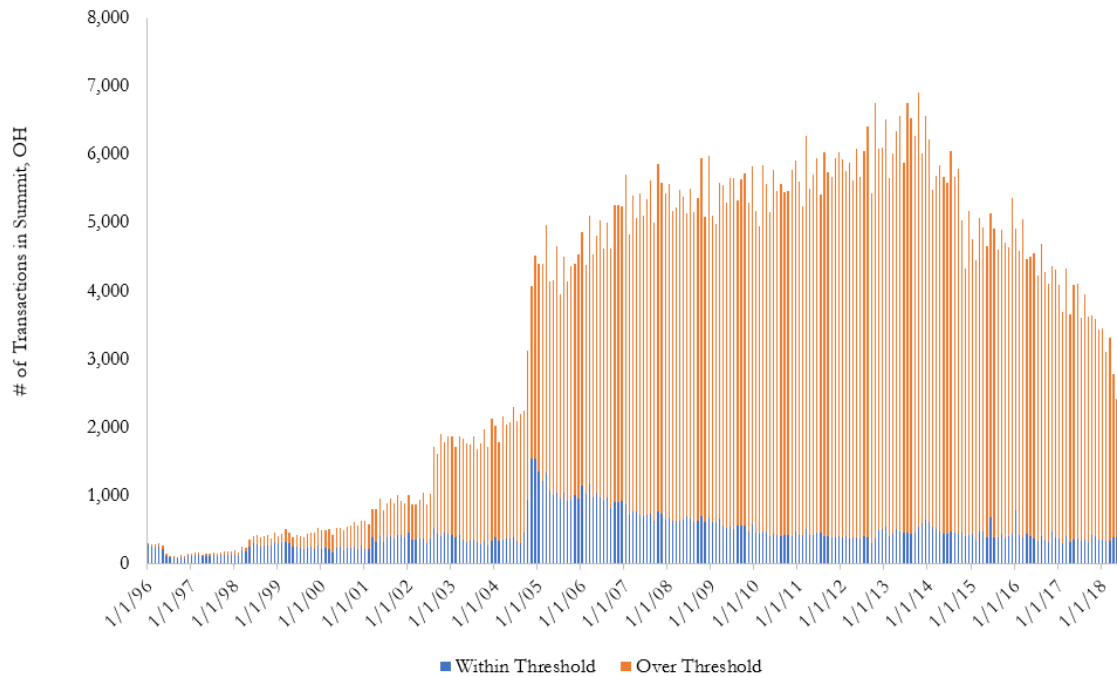
149. Figure 19 illustrates total opioid shipments into Cuyahoga County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after 2014. The Maximum Daily Dosage Units Threshold methodology flags 83.3% of transactions accounting for 92.0% of dosage units, 91.1% of MME and 84.8% of drug weight shipped into Cuyahoga County.

Figure 19 Maximum Daily Dosage Units, Any Order Subsequent to an Flagged Order, Cuyahoga County



150. Figure 20 illustrates total opioid transactions into Summit County. The Maximum Daily Dosage Units Threshold methodology flags 86.8% of transactions accounting for 94.4% of dosage units, 94.0% of MME and 89.6% of drug weight shipped into Summit County.

Figure 20 Maximum Daily Dosage Units, Any Order Subsequent to an Flagged Transactions, Summit County



151. Table 32 and Table 33 summarize the transactions in transactions flagged based on the Maximum Daily Dosage Units Threshold Approach in Cuyahoga and Summit Counties.

Table 32 Maximum Daily Dosage Units Threshold Flagged Transactions in Cuyahoga County, 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	107,350	52,226	18,018	3,366	n/a	3,292	184,252
Anda, Inc	904	2,129	46	20	n/a	95	3,194
Cardinal Health	166,869	88,662	30,253	4,244	n/a	10,147	300,175
CVS	n/a	115,449	n/a	n/a	n/a	5,951	121,400
Discount Drug Mart	n/a	32,424	0	n/a	n/a	2,036	34,460
H. D. Smith	311	19	0	4	n/a	18	352
HBC Service Co	5,978	46,103	0	0	n/a	10	52,091
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	118,299	88,832	9,825	1,154	n/a	1,298	219,408
Miami-Luken	2	133	0	0	n/a	0	135
Prescription Supply	5,351	521	1,471	162	n/a	6	7,511
Rite Aid	n/a	21,291	n/a	n/a	n/a	1,343	22,634
Walgreens	97,777	107,036	21,923	3,733	n/a	6,949	237,418
Wal-Mart	14,593	26,963	818	76	n/a	387	42,837
Total	517,434	581,788	82,354	12,759	n/a	31,532	1,225,867

Table 33 Maximum Daily Dosage Units Threshold Flagged Transactions in Summit County, 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	80,140	59,406	23,672	7,252	n/a	2,196	172,666
Anda, Inc	1,130	1,566	205	41	n/a	19	2,961
Cardinal Health	104,253	52,285	27,023	6,358	n/a	4,104	194,023
CVS	n/a	49,701	n/a	n/a	n/a	1,759	51,460
Discount Drug Mart	n/a	8,435	0	n/a	n/a	357	8,792
H. D. Smith	0	74	0	n/a	n/a	0	74
HBC Service Co	2,858	29,533	33	0	n/a	0	32,424
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	96,342	69,871	21,349	5,883	n/a	518	193,963
Miami-Luken	3,184	1,404	476	53	n/a	0	5,117
Prescription Supply	15	5	0	1	n/a	0	21
Rite Aid	n/a	12,512	n/a	n/a	n/a	177	12,689
Walgreens	40,192	50,679	12,257	3,059	n/a	353	106,540
Wal-Mart	7,411	14,905	1,013	169	n/a	96	23,594
Total	335,525	350,376	86,028	22,816	n/a	9,579	804,324

F. Additional Identification

152. I have been asked by Counsel to assume that Chain Distributors may have had knowledge of - or information available to inform them of - opioid shipments from all Distributors to the Chain Distributor's affiliated pharmacies. I have re-run the five identification routines described above assuming that the Chain Distributors could have flagged transactions based on this expanded information set and report the results for the Chain Distributors in Table 34 through Table 43 below. Additional charts and tables reflecting the result of applying methodologies below to each Chain Distributor are in Appendix 11.

1. Maximum Monthly, Trailing Six-month Threshold

Table 34 Trailing Six-Month Maximum Threshold Flagged Transactions, Cuyahoga County, OH 2006-2014

No. of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	65,249	86,461	9,769	908	1,130	12,154	175,671
Discount Drug Mart	18,313	24,531	2,416	98	0	1,786	47,144
HBC / Giant Eagle	27,810	74,444	297	20	0	5,202	107,773
Rite Aid	45,986	38,903	5,553	282	396	6,000	97,120
Walgreens	100,484	86,597	22,490	5,374	1,294	12,712	228,951
Wal-Mart	10,520	22,448	213	74	0	1,185	34,440
Total	268,362	333,384	40,738	6,756	2,820	39,039	691,099

Table 35 Trailing Six-Month Maximum Threshold Flagged Transactions, Summit County, OH 2006-2014

No. of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	34,067	37,475	9,393	2,242	986	3,487	87,650
Discount Drug Mart	6,052	6,300	1,305	245	71	420	14,393
HBC / Giant Eagle	21,246	50,968	3,772	941	119	2,415	79,461
Rite Aid	18,263	18,990	4,587	1,106	651	1,665	45,262
Walgreens	39,482	39,538	13,088	4,099	280	3,772	100,259
Wal-Mart	5,960	13,442	522	158	0	494	20,576
Total	125,070	166,713	32,667	8,791	2,107	12,253	347,601

2. *Twice Trailing Twelve-Month Average Pharmacy Dosage Units*

Table 36 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, 2006-2014

No. of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	30,660	17,708	4,925	639	1,731	15,169	70,832
Discount Drug Mart	4,897	1,600	1,637	145	140	3,532	11,951
HBC / Giant Eagle	0	0	126	78	102	3,543	3,849
Rite Aid	31,051	8,623	3,661	680	1,162	6,999	52,176
Walgreens	65,885	5,542	8,621	4,170	2,943	18,839	106,000
Wal-Mart	4,883	0	154	57	72	1,101	6,267
Total	137,376	33,473	19,124	5,769	6,150	49,183	251,075

Table 37 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Summit County, OH 2006-2014

No. of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	21,880	18,368	7,226	2,271	1,731	6,221	57,697
Discount Drug Mart	0	62	1,158	398	306	1,221	3,145
HBC / Giant Eagle	8,118	14,073	3,617	1,274	660	3,222	30,964
Rite Aid	16,583	11,853	4,192	1,154	969	3,227	37,978
Walgreens	29,185	6,270	10,156	3,704	1,525	4,954	55,794
Wal-Mart	1,556	0	474	164	99	484	2,777
Total	77,322	50,626	26,823	8,965	5,290	19,329	188,355

3. *Three Times Trailing Twelve-Month Average Pharmacy Dosage Units*

Table 38 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Cuyahoga County, OH 2006-2014

No. of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	12,948	6,453	2,522	322	1,282	8,874	32,401
Discount Drug Mart	0	0	514	98	0	2,227	2,839
HBC / Giant Eagle	0	0	0	20	0	1,537	1,557
Rite Aid	19,405	3,677	2,009	119	515	3,770	29,495
Walgreens	27,854	0	2,086	1,391	1,656	8,959	41,946
Wal-Mart	1,385	0	154	15	9	38	1,601
Total	61,592	10,130	7,285	1,965	3,462	25,405	109,839

Table 39 Three Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Summit County, OH 2006-2014

No. of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	9,034	9,669	3,800	1,407	1,324	2,239	27,473
Discount Drug Mart	0	21	390	208	71	518	1,208
HBC / Giant Eagle	5,929	8,228	2,401	941	216	1,976	19,691
Rite Aid	9,980	2,895	3,074	925	774	1,093	18,741
Walgreens	15,672	0	2,247	1,579	668	1,942	22,108
Wal-Mart	313	0	458	158	36	381	1,346
Total	40,928	20,813	12,370	5,218	3,089	8,149	90,567

4. *Maximum 8,000 Dosage Units Monthly*

Table 40 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Cuyahoga County, OH 2006-2014

No. of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	50,282	61,480	0	0	0	0	111,762
Discount Drug Mart	13,464	20,375	0	0	0	0	33,839
HBC / Giant Eagle	6,877	50,434	0	0	0	0	57,311
Rite Aid	35,750	19,305	0	0	0	0	55,055
Walgreens	99,861	73,377	0	0	0	0	173,238
Wal-Mart	4,814	12,998	0	0	0	0	17,812
Total	211,048	237,969	0	0	0	0	449,017

Table 41 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Summit County, OH 2006-2014

No. of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	34,946	38,798	0	0	0	71	73,815
Discount Drug Mart	3,424	5,523	0	0	0	0	8,947
HBC / Giant Eagle	15,938	42,894	0	0	0	0	58,832
Rite Aid	18,618	20,304	0	0	0	0	38,922
Walgreens	42,349	42,821	0	0	0	0	85,170
Wal-Mart	1,345	6,806	0	0	0	0	8,151
Total	116,620	157,146	0	0	0	71	273,837

5. *Maximum Daily Dosage Units*

Table 42 Maximum Daily Dosage Units Threshold Flagged Transactions in Cuyahoga County, 2006-2014

No. of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	63,914	96,391	11,355	1,753	n/a	7,237	180,650
Discount Drug Mart	18,246	26,801	3,023	202	n/a	381	48,653
HBC / Giant Eagle	21,554	74,603	382	24	n/a	1,238	97,801
Rite Aid	45,264	42,065	5,584	638	n/a	3,969	97,520
Walgreens	105,081	96,179	24,784	5,156	n/a	8,830	240,030
Wal-Mart	9,093	24,354	391	74	n/a	491	34,403
Total	263,152	360,393	45,519	7,847	n/a	22,146	699,057

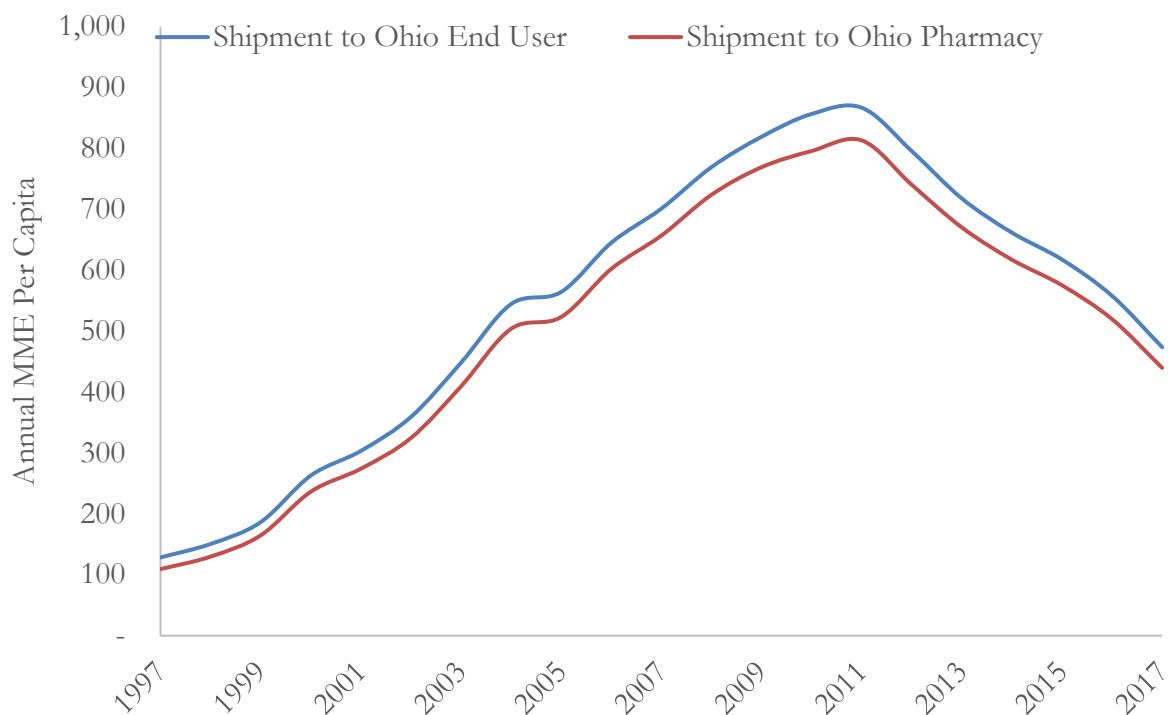
Table 43 Maximum Daily Dosage Units Threshold Flagged Transactions in Summit County, 2006-2014

No. of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	36,542	41,052	9,946	2,592	n/a	2,020	92,152
Discount Drug Mart	6,050	6,849	1,692	245	n/a	170	15,006
HBC / Giant Eagle	20,496	51,934	3,737	873	n/a	594	77,634
Rite Aid	19,365	20,835	4,762	1,388	n/a	736	47,086
Walgreens	42,932	43,575	14,064	4,225	n/a	416	105,212
Wal-Mart	4,273	14,134	662	154	n/a	105	19,328
Total	129,658	178,379	34,863	9,477	n/a	4,041	356,418

X. Excessive Shipments

153. I plot total per capita opioid MMEs shipped into Ohio based on the public ARCOS Data from 1997 to 2017 in Figure 21. Figure 21 also includes per capita opioid MMEs shipped into Ohio pharmacies. Figure 22 and Figure 23 plot total per capita opioid MMEs shipped into 3-digit zip-codes which Cuyahoga County and Summit County encompass.⁵⁶

Figure 21 Per Capita Opioid MME in Ohio, 1997-2017



⁵⁶ARCOS Retail Drug Summary Reports report County and 3-digit zip-code information. Cuyahoga County and Summit County boundaries do not coincide precisely with 3-digit zip-code boundaries. These charts - and any other chart, figure or analysis at the County level using ARCOS Retail Drug Summary Reports - use the 3-digit zip-codes 441 for Cuyahoga County and 443 for Summit County.

Figure 22 Per Capita Opioid MME in Cuyahoga County, OH 1997-2017

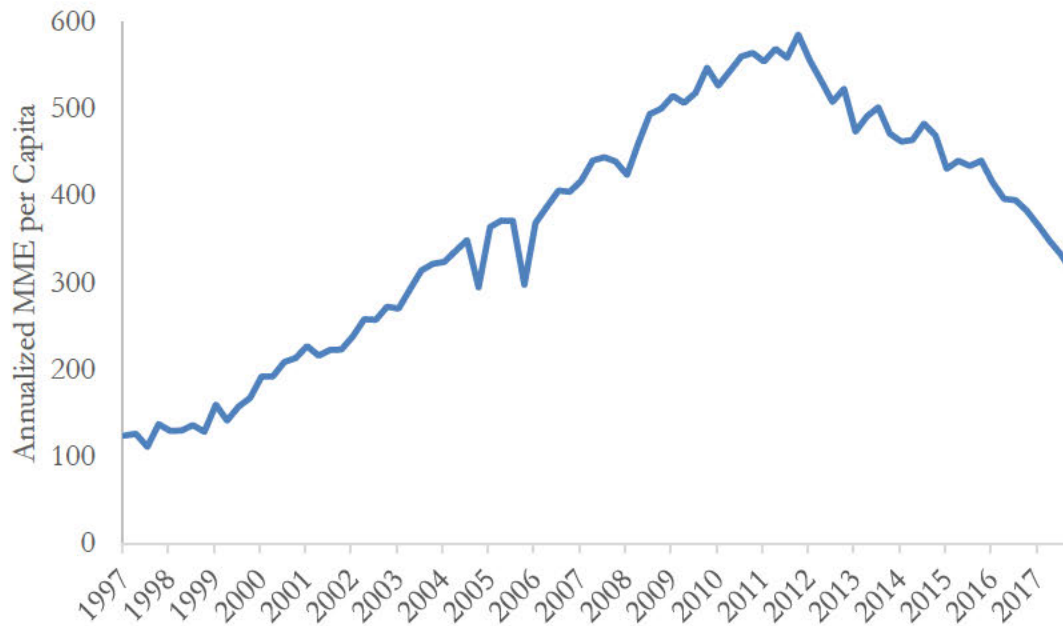
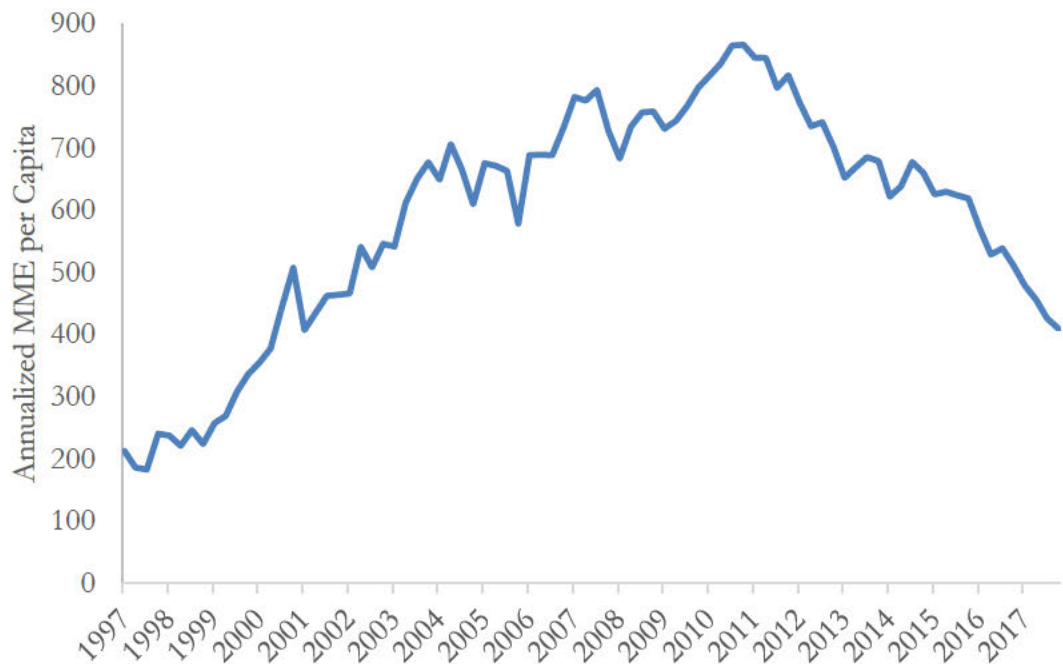


Figure 23 Per Capita Opioid MME in Summit County, OH 1997-2017



154. Figure 21, Figure 22 and Figure 23 illustrate a similar pattern. In Ohio and in Cuyahoga County and Summit County per capita opioid MME

increased from 1997 to 2010 and thereafter declined so that per capita opioid MME in 2017 was 3.7 times per capita opioid MME in 1997 in Ohio.

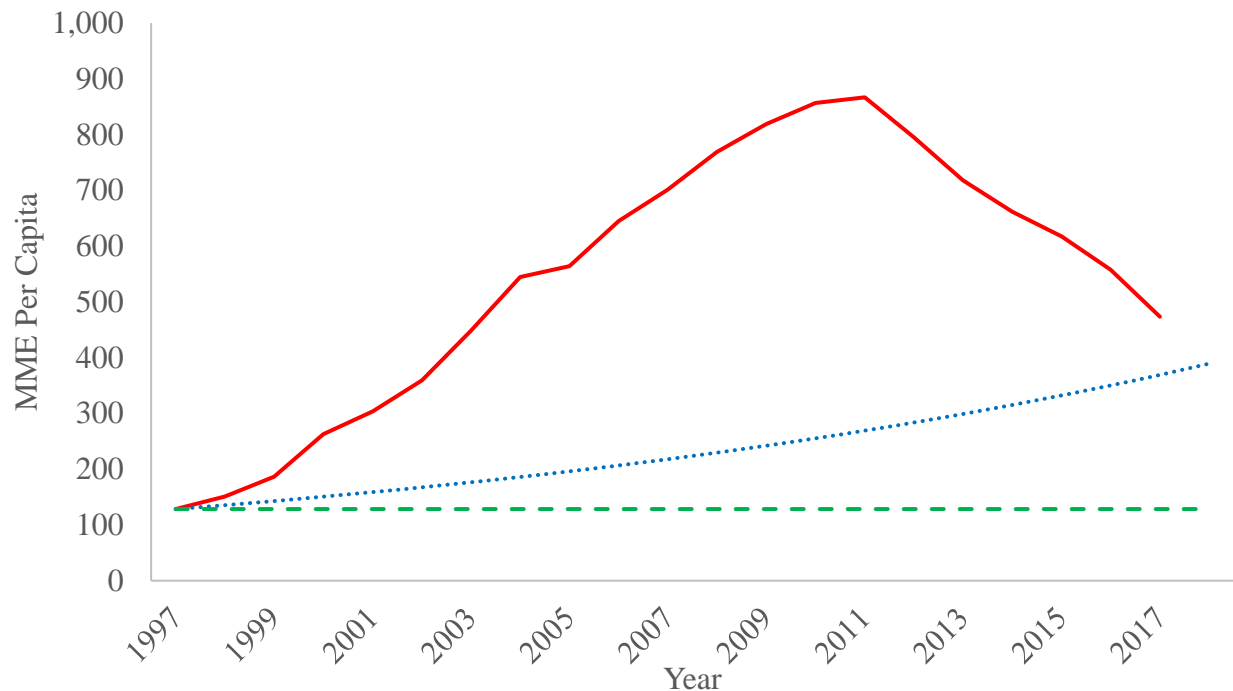
155. A possible upper bound on the medically necessary opioid MME per capita baseline is the per capita MME interpolated from 1997 to 2018. This baseline assumes that all prescriptions of opioids in 1997 and in 2018 were medically necessary and that the drivers of legitimate opioid use (eg. aging of the population) evolve gradually rather than discontinuously over time. Plaintiffs allege that opioid consumption in 2018 remained excessive and was still influenced by the Defendants' alleged fraudulent conduct.

156. A possible lower bound on the medically necessary opioid MME per capita baseline is the 1997 per capita MME. This baseline assumes that all prescriptions of opioids in 1997 were necessary and opioid use per capita beyond 1997 levels were unnecessary.

157. I plot these two baselines in Figure 24 along with the per capita MME shipped into Ohio from Figure 21.

Figure 24 Per Capita Opioid Actual and Baseline MME to Ohio, 1997-2018

— Actual MME Per Capita 1997-2018 Interpolated Baseline - - - 1997 Constant Baseline



158. The difference between the actual shipments of opioids into Ohio and the baseline is an estimate of the excessive opioids shipped into Ohio.

- Using the 1997-2018 interpolated baseline, 76.24 billion MME or 58.6% of the 130.18 billion total MME shipped into Ohio from 1998 to 2017 was excessive.
- Using the 1997 baseline, 100.66 billion MME or 77.3% of the 130.18 billion total MME shipped into Ohio was excessive. See Table 44.

Table 44 Excessive Opioid MME in Ohio

Year	Ohio MME (billions)	1997-2018 Interpolated			1997 Per Capita		
		Baseline			Baseline		
		Baseline	Excess	Excess%	Baseline	Excess	Excess%
1997	1.45	1.45	-		1.45	-	
1998	1.70	1.53	0.17	10.1%	1.45	0.25	14.7%
1999	2.11	1.62	0.50	23.4%	1.46	0.66	31.1%
2000	2.99	1.71	1.28	42.8%	1.46	1.53	51.1%
2001	3.45	1.81	1.65	47.7%	1.46	1.99	57.7%
2002	4.10	1.91	2.19	53.4%	1.47	2.63	64.2%
2003	5.12	2.02	3.11	60.7%	1.47	3.66	71.3%
2004	6.24	2.13	4.11	65.9%	1.47	4.76	76.4%
2005	6.47	2.25	4.22	65.3%	1.47	5.00	77.2%
2006	7.41	2.37	5.03	68.0%	1.47	5.93	80.1%
2007	8.06	2.50	5.56	68.9%	1.48	6.59	81.7%
2008	8.86	2.64	6.21	70.2%	1.48	7.38	83.3%
2009	9.44	2.79	6.65	70.5%	1.48	7.96	84.3%
2010	9.88	2.94	6.94	70.2%	1.48	8.40	85.0%
2011	10.01	3.11	6.90	69.0%	1.48	8.52	85.2%
2012	9.19	3.27	5.91	64.4%	1.48	7.70	83.9%
2013	8.30	3.46	4.84	58.4%	1.49	6.82	82.1%
2014	7.67	3.65	4.02	52.4%	1.49	6.18	80.6%
2015	7.17	3.86	3.31	46.2%	1.49	5.68	79.2%
2016	6.48	4.07	2.41	37.2%	1.49	4.99	77.0%
2017	5.52	4.30	1.22	22.0%	1.50	4.02	72.9%
2018 ⁵⁷		4.55			1.50		
1998-2017	130.18	53.94	76.24	58.6%	29.52	100.66	77.3%

159. Opioid dosage units dispensed in Ohio have declined 37% from 2012 to 2018. The percentage decline in dosage units dispensed in Ohio has increased each year suggesting that even the 2018 levels exceed the medically necessary level. My estimates of excessive opioid shipments into Ohio can be varied to reflect how much, if any, of the increase from 1997 to 2018 in per

⁵⁷ Estimated from the 2017 level reported in the RDSRs and 2018 decline from 2017 reported in Ohio Automated Rx Reports System, 2018 Annual Report, State of Ohio Board of Pharmacy, Section 1, Chart 1 available at [www.ohiopmp.gov/documents/Annual%20Report%20\(2018\).pdf](http://www.ohiopmp.gov/documents/Annual%20Report%20(2018).pdf)

capita opioid MME above the 1997 levels was medically justifiable. See Table 45.

Table 45 Excessive MME in Ohio and MME by % Increase From 1997 Per Capita MME That was Legitimate

% 1997-2018 Increase Legitimate	% Excessive in Ohio	
	1998-2017	2006-2014
100%	58.6%	66.1%
80%	62.3%	69.5%
60%	66.1%	72.9%
40%	69.8%	76.3%
20%	73.6%	79.7%
0%	77.3%	83.1%

- If 100% of the increase in opioids dispensed in Ohio in 2018 compared to the 1997 per capita level were medically necessary, 58.6% of the opioids dispensed from 1998 to 2017 and 66.1% of the opioids dispensed from 2006 to 2014 were excessive.
- If 80% of the increase in opioids dispensed in Ohio in 2018 compared to the 1997 per capita level were medically necessary, 62.3% of the opioids dispensed from 1998 to 2017 and 69.5% of the opioids dispensed from 2006 to 2014 were excessive.
- If 60% of the increase in opioids dispensed in Ohio in 2018 compared to the 1997 per capita level were medically necessary, 66.1% of the opioids dispensed from 1998 to 2017 and 72.9% of the opioids dispensed from 2006 to 2014 were excessive.
- If 40% of the increase in opioids dispensed in Ohio in 2018 compared to the 1997 per capita level were medically necessary,

69.8% of the opioids dispensed from 1998 to 2017 and 76.3% of the opioids dispensed from 2006 to 2014 were excessive.

- If 20% of the increase in opioids dispensed in Ohio in 2018 compared to the 1997 per capita level were medically necessary, 73.6% of the opioids dispensed from 1998 to 2017 and 79.7% of the opioids dispensed from 2006 to 2014 were excessive.
- If none of the increase in opioids dispensed in Ohio in 2018 compared to the 1997 per capita level were medically necessary, 77.3% of the opioids dispensed from 1998 to 2017 and 83.1% of the opioids dispensed from 2006 to 2014 were excessive.

160. My estimates of the percentage excessive shipments into Ohio in Table 45 - which average 71.3% - are a useful frame of reference for evaluating the transactions flagged by the methods in the previous subsections. For example, the Maximum Monthly Trailing 6-Month Threshold flagged 76.0% of transactions, 89.6% of dosage units and 73.5% of MME shipped to pharmacies in Cuyahoga County and 75.4% of transactions, 88.5% of dosage units and 71.4% of MME shipped to pharmacies in Summit County. The purpose of identifying transactions – to determine which transactions warrant some further due diligence – is likely to only be met by flagging more transactions than those which are used to fill medically unnecessary prescriptions. Thus, the decline in opioid use in Ohio and the implication that more than 70% of opioids shipped into Ohio were excessive, supports my identification of transactions.

XI. Charts and Reports

161. In addition to the Figures and Tables in the body of this report, I have created a set of Charts and Tables that are too voluminous to be displayed and discussed fully here in. Those additional Charts and Tables are attached in Appendix 9 and described generally in this section.

A. State Hydrocodone and Oxycodone MME Per Capita, 1997-2017

162. Using ARCOS data produced by the DEA for 2006-2014 and public ARCOS Retail Drug Summary Reports otherwise, I plot total hydrocodone and oxycodone MME per capita, by State from 1997 to 2017. There is one chart and a 2-page backup summary table for each hydrocodone and oxycodone.

163. In the two charts, the line reflecting Ohio MME per capita is highlighted using red. Kentucky, Indiana, Michigan, Pennsylvania, West Virginia are highlighted in purple, blue and orange respectively. The rest of the states are drawn in light grey.

164. The 2-page backup summary tables report hydrocodone and oxycodone MME per capita each year and averaged over the 1997-2017 period. The states are sorted by average MME per capita over the entire 21-year period.

B. All Defendants Combined and Individually - 12 Opioid Drug Distribution by Defendant

165. Using ARCOS data produced by the DEA for 2006-2014 and Defendant transaction data otherwise, I plot all Defendants' shipments of

twelve opioid drugs into Cuyahoga County and into Summit County from 1996 to 2018.

166. There are two versions of this chart for each County. One version is a stacked bar chart in which the height of a colored section of each bar corresponds to shipments by each Defendant according to the color-coded legend. The second version of the chart is a line graph in which each Defendant's shipments into each County is reflected by the same color-coding as the stacked bar chart.

C. All Defendants, Combined and Individually, 12 Opioid Drug Distribution by Drug Code

167. Using ARCOS data produced by the DEA for 2006-2014 and Defendant transaction data otherwise, I plot all Defendants' combined shipments of oxycodone, hydrocodone, codeine, fentanyl, morphine, hydromorphone and "other" opioid drugs into Cuyahoga County and into Summit County from 1996 to 2018 in dosage units. "Other" opioid drugs include dihydrocodeine, levorphanol, meperidine, oxymorphone, powdered opium, and tapentadol.

168. The stacked bar charts illustrate the dosage units of each drug identified in the color-coded legend. The vast majority of dosage units each year and in both Counties is in oxycodone and hydrocodone.

D. All Seller 12 Opioid Drug Distribution in MME, Cuyahoga County and Summit County, by Drug

169. Using public ARCOS Retail Drug Summary Reports, I plot all shipments of oxycodone, hydrocodone, codeine, fentanyl, morphine,

hydromorphone and “other” opioid drugs into Cuyahoga County and into Summit County from 1996 to 2017 in MME.

170. The stacked bar charts illustrate the MME of each drug identified in the color-coded legend. Measured by MME, most of the opioids shipped into both counties continues to be oxycodone but fentanyl is second followed by hydrocodone because of fentanyl’s much higher relative strength.

171. ARCOS Retail Drug Summary Reports report County and 3-digit zip-code information. Cuyahoga County and Summit County boundaries do not coincide precisely with 3-digit zip-code boundaries. These charts - and any other chart, figure or analysis at the County level using ARCOS Retail Drug Summary Reports - use the 3-digit zip-codes 441 for Cuyahoga County and 443 for Summit County.

E. Individual Defendant Oxycodone Distribution in OH by Total Dosage, Total MME, Total Drug Base Weight

172. Using ARCOS data produced by the DEA for 2006-2014 and Defendant transaction data otherwise, I plot each Defendants’ shipments of oxycodone into Cuyahoga County and into Summit County monthly in dosage units, MME and base weight. There are 84 charts – 14 Defendants, 2 counties, 3 measures.

F. Individual Defendant Hydrocodone Distribution by Total Dosage, Total MME, Total Drug Base Weight

173. Using ARCOS data produced by the DEA for 2006-2014 and Defendant transaction data otherwise, I plot each Defendants’ shipments of hydrocodone into Cuyahoga County and into Summit County monthly in

dosage units, MME and base weight. There are 84 charts (ie. 14 Defendants, 2 counties, 3 measures) of this type.

G. Oxycodone and Hydrocodone Distribution to Individual Pharmacies by Defendant

174. Using ARCOS data produced by the DEA for 2006-2014 and Defendant transaction data otherwise, I plot all Defendants' shipments of oxycodone and hydrocodone to each pharmacy that received hydrocodone in Cuyahoga County and in Summit County in dosage units. There are 1,716 charts of this type.

H. Pharmacy Reports

175. Using ARCOS data produced by the DEA for 2006-2014, I tabulate and report dosage units, MME and drug weight shipped to retail and chain pharmacies in Cuyahoga County and Summit County. I list the pharmacies in each county sorted by total MME. For each year, I report the dosage units and drug weight of oxycodone, hydrocodone, morphine, and codeine and the dosage units and MME of the twelve non-treatment drugs received by each pharmacy from each Distributor. For comparison purposes, I list the average pharmacy MME in the county and the state each year and each pharmacy's percentile rank by MME in the state each year.

176. The Pharmacy Report for Cuyahoga County is 1,250 pages long and Distributor Report for Summit County is 557 pages long.

I. Distributor Reports

177. Using ARCOS data produced by the DEA for 2006-2014, I tabulate and report the total Dosage Units per capita by year and by state. I

rank states by average dosage units per capita over the 2006-2014 period and plot the 25 states with highest average dosage units per capita.

178. I tabulate and report the total MME per capita by year and by state and rank states by average MME per capita over the 2006-2014 period and plot the 25 states with highest average MME per capita.

179. I tabulate and report the MME and Dosage Units each year and totaled over the 2006-2014 period and market shares over the 2006-2014 period for each Distributor. I further break down the Distributors' annual shipments and total shipments and market share over the 2006-2014 period into the Distributors' individual DEA numbers.

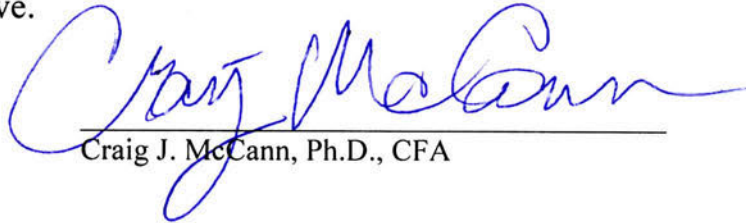
180. The Distributor Report for Cuyahoga County is 72 pages long and Distributor Report for Summit County is 63 pages long.

XII. Conclusion

181. Based upon my comparison of the ARCOS Data produced by the DEA, the public ARCOS Retail Drug Summary Reports and the Defendants transaction data, I conclude that - after correcting a relatively small number of records - the ARCOS Data produced by the DEA is complete and reliable.

182. I further conclude that Cardinal Health's transaction records produced in discovery are a reliable source of transactions data before 2006 and after 2014. More generally, with the exception of AmerisourceBergen, the other Defendants' transaction data is also a reliable source of transaction data for the periods covered by its production.

183. The ARCOS Data can be used to identify transactions into a state, county, zipcode or individual pharmacy meeting certain criteria as I have illustrated above.



Craig J. McCann, Ph.D., CFA